Electronic Services - Hayward, Ca
M19670X

PRELIMINARY MANUAL

SPECTRACOM MODEL 8131/8132

FREQUENCY STANDARD OSCILLATOR

MP MASTER
MA26540

PRELIMINARY OPERATING MANUAL

SPECTRACOM

FREQUENCY STANDARD OSCILLATOR

MODEL 8131

Because the final instruction manual for the Model 8131 is not yet available, this preliminary information is being furnished with each unit. The final instruction manual containing complete maintenance information will be sent to you when it is published. Please fill out the enclosed form and return it to SPECTRACOM so that the manual will be sent to the person responsible for the instrument's maintenance.

Spectracom Corp.
101 Despatch Drive
East Rochester, NY 14445
(716) 381-4827

TO SPECTRACOM CORPORATION:

Please send the final instruction manual for the Model 8131 to the following address as soon as it is available. The name shown below is the person who will be responsible for the equipment maintenance:

Name:

Mailing Address:

Equipment Serial No.

Signature _____ _____Date_____

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WARRANTY

Spectracom Corporation
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East Rochester, New York 14445
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Spectracom Corporation warrants to the original purchaser each new instrument to be free from defects in material and workmanship for a period of one year after shipment. Repair or replacement, at our option, will be made when our examination indicates that defects are due to workmanship or materials. Electron tubes, batteries, fuses, and lamps that have given normal service are excluded from warranty coverage. All warranty returns must first be authorized by the factory.

This warranty does not apply to any of our products which have been repaired or altered by persons not authorized by Spectracom Corporation or not in accordance with instructions furnished by us. If the instrument is defective as a result of misuse, improper repair, or abnormal conditions or operations, or if any serial number or seal has been removed or altered, the warranty is void and repairs will be billed at cost.

This warranty is in lieu of all other obligations or liabilities expressed or implied and Spectracom Corporation neither assumes nor authorizes any person to assume for them, any other liability in connection with sales of its products.

REPAIR AND MAINTENANCE

Instruments should be returned only upon authorization from Spectracom Corporation or its authorized sales and service representative. Please provide the following information in order to enable us to serve you efficiently:

1. Model Number and type
2. Serial Number
3. Description of trouble
4. Conditions and hours of use

Transportation to the factory is to be prepaid by the purchaser.

For assistance contact your nearest Spectracom sales representative.

WARRANTY REGISTRATION

Spectracom Corporation
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East Rochester, New York 14445
(716) 381-4827

Dear Customer,

Spectracom occasionally contacts customers regarding our products. We must know to whom we should send manual updates, change notices, and new product information. Because people sometimes change job assignments, we request department, mail station, and title information to ensure that correspondence in future years will reach either the user of our products or his/her supervisor. In filling out the registration, please use the title/mail station/department of the supervisor most interested in keeping the equipment and its documentation up-to-date. Thank you.

- -

Name _____ Title _____

Department _____ Mail Stop _____

Company _____ Model Number _____

Address _____ Serial No. _____

City _____ Date Installed _____

State_____ Zip _____

Telephone_____ Ext. _____

Remarks (problems, suggestions, etc.): _____

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OPERATING INSTRUCTIONS

for

MODEL 8131 OSCILLATOR

INSTALLATION: Oscillator plug-in may be powered from any Tektronix TM-500 series Mainframe. Be sure that the unit is plugged firmly into its connector at the rear of the Mainframe so that the edge connector makes good contact with the oscillator circuit board. Be sure that the Mainframe power switch is turned off until after the plug-in is firmly in place.

FRONT PANEL FUNCTIONS:

Output Connector: This BNC connector provides either 0.1, 1.0, 5.0, or 10 MHz as set with front panel push button switch.

Oven Cold/Warm Lamps: When power is first applied to the oscillator plug-in, the red lamp will indicate warm-up is in progress. After approximately 19-20 minutes have passed, the red light will go off and the green light will come on, indicating sufficient warm-up time for the oscillator to be within $\pm 2 \times 10^{-8}$ of its final frequency.

Push Button Selector Switch: Selects front panel output frequency as above.

Digital Frequency Adjustment: This digital potentiometer, similar to a set of thumbwheel selector switches, is used for precision adjustments of the oscillator output frequency. The digital readout is calibrated in parts in 10^{10}, with the right hand digit providing adjustment steps with this resolution. Adjustments of this digital control are typically made after comparison of the output frequency with a primary frequency standard such as station WWVB. This signal can be received using the Spectracom Model 8163 WWVB Receiver/Comparator, or similar instrument. If the oscillator output frequency is found to be off, appropriate adjustment upward or downward is made using this front panel digital control.

USING THE FRONT PANEL OUTPUT: When the appropriate output frequency has been chosen using the front panel push button switches, it may be used as a frequency standard signal. A typical application might be to measure this frequency with the counter that you wish to calibrate, noting the error with which the counter counts 1.0 MHz. The internal clock oscillator in the counter may then be adjusted so that the counter reads exactly 1.000 000 MHz. This adjustment should not be made until the counter has been warmed up for at least an hour, and preferably more. Refer to the counter instruction manual for detailed procedures.

The oscillator aging rate is typically 3×10^{-9} per day after 24 hours of warm up. Thus, the accuracy of the oscillator at some known time period after calibration can be estimated by knowing this aging rate.

Caution should be used when long lengths of coaxial cable are used to feed this signal to the load. Because the output is a TTL square wave from a line driver output, 93-ohm terminated cable should be used for long runs where wave form must be preserved. 50-ohm terminated cable may also be used with reasonable success, especially at the lower frequencies.

Termination impedance is less critical for a 1 MHz output than for a 10 MHz output.

CONNECTION TO TEKTRONIX FREQUENCY COUNTERS: The oscillator output signal may be used as the time base for Tektronix counters that are plugged into the same Mainframe. Two parallel outputs are provided from the rear interface connector to the Mainframe for this purpose, allowing operation of up to 2 Tektronix counters to use the same oscillator as their external time base. To do this, make the following connections in the TM-500 Mainframe and in the counter:

NOTE: The following instructions assume that one single counter will be operated from the oscillator plug-in. If a second counter interface is required, the same instructions should be followed taking the output from the oscillator pin 14B.

NOTE: Switch S1 on the oscillator's printed circuit board must be set for either 1.0 or 10 MHz to choose the external clock frequency from which the counter will operate. All of the Tektronix counters listed below will operate using a 1.0 MHz external clock frequency. The DC-508 may also be set to accept a 10 MHz external clock frequency as stated below.

DC-501: Connect 8131 pin 14A to DC-501 pin 14A.
Connect 8131 pin 17A to DC-501 pin 17A.
Install coaxial jumper in DC-501 from pin 14A (shield to 17A) to U209-14. Remove U200 (U201 if Option 1 instrument.)

DC-502: Same as DC-501.

DC-503: Connect 8131 pin 14A to DC-503 pin 14A.
Connect 8131 pin 17A to DC-503 pin 17A.
Place DC-503 internal jumper P250 in EXT position.
Replace DC-503 R251 with a wire jumper (does not affect normal counter operation).

DC-504: Connect 8131 pin 14A to DC-504 pin 14A.
Connect 8131 pin 17A to DC-504 pin 17A.
Place the DC-504 Int/Ext switch in the EXT position and connect the printed circuit pads marked EO with a coaxial jumper.

DC-505: Connect 8131 pin 14A to DC-505 pin 14A.
Connect 8131 pin 17A to DC-505 pin 17A.
Place the Ext Clock switch of the DC-505 in the EXT position.
Replace DC-505 R897 with a wire jumper (does not affect normal counter operation).

DC-508: Connect 8131 pin 14A to DC-508 pin 14A.
Connect 8131 pin 17A to DC-508 pin 17A.
Set the counter internal jumper to the EXT position.
If a 1.0 MHz external clock frequency is chosen in the 8131, set the counter internal selection jumper J1290 in the 1.0 MHz position. If 10 MHz is used, this jumper must be connected between pins 4 and 5 for 10 MHz operation.

OPERATION WITH BATTERY PLUG-IN: This oscillator may be operated with a Spectracom Model 8132 Battery Power Supply. This plug-in power supply has its batteries float-charged from the oscillator power supply when appropriate jumpering is done in the Mainframe. If the power is then removed from the Mainframe, the battery pack will keep the oscillator and its oven operating for up to 10 hours. Oscillator output stages are not left on during battery operation in order to preserve battery charge. Thus, to use the oscillator output frequencies the Mainframe must be plugged into an operating power line again.

Mainframe jumpering required to use this battery power supply consists of a connection from pin 16B to pin 16B in the appropriate Mainframe slots. Use wire size at least as large as #20 AWG. See battery power supply instructions for more details.

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MODEL 8132 BATTERY POWER SUPPLY

TM-500 Main Frame Jumpering: To use the 8132 with the Model 8131 Oscillator plug-in, jumper pins 16B to pin 16B in the Mainframe connectors where the two units will be used. This allows the battery to be float-charged by the 8131 whenever the Mainframe power is on. If the power line fails or if the Mainframe power switch is turned off, the oscillator and oven will operate from the battery for up to 8 hours. Oscillator output stages are not operated by the battery.

Operating Considerations: Battery life is normally 4-6 years or over 100 discharge cycles to 50% capacity. Do not leave battery in a discharged state for long periods or the life will be reduced.

W A R N I N G

This battery will furnish very high currents into short circuits! Accidental shorts can be dangerous and must be avoided. Never place the 8132 where tools, wires, or any metal might short circuit the terminals.

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ALIGNMENT PROCEDURE FOR MODEL 8131 OSCILLATOR

Regulator Adjustments

1. Preset controls as follows: (if alignment has been previously performed, controls may be left as is.):

   Set R17 to center of range
   Set R13 to center of range

2. Connect the negative lead of a DVM to the chassis. Connect the positive lead to TP1 (brown test point) and select the +200 volt full scale range.

3. Apply power to the unit and adjust R17 for 21.0 volts.

4. Move the positive DVM lead to TP2 (red test point). Adjust R13 for a DVM reading of +27.6 volts at +25°C ambient. The set voltage should be changed by -0.05 volts per degree C for room temperatures other than +25°C. The following table gives the voltage to set for various ambient temperatures.

Temperature	Set Volts
17°C	28.00V
18°C	27.95V
19°C	17.90V
20°C	27.85V
21°C	27.80V
22°C	27.75V
23°C	27.70V
24°C	27.65V
25°C	27.60V
26°C	27.55V
27°C	27.50V
28°C	27.45V
29°C	27.40V
30°C	27.35V

5. Apply glyptol or torque seal to R13 and R17.

6. Temporarily disconnect the positive lead of the DVM, and set the DVM for a full scale range of +2.0 amperes. Temporarily reconnect the positive DVM lead to TP2. A reading of 900 $\pm$ 100 milliamperes should be obtained.

7. Disconnect the DVM.

Oscillator Alignment

1. Use an oscilloscope to check the output signal levels and approximate frequencies.

   A. With front panel push button switch set as shown below, observe front panel output pulses of 2.5 V peak-to-peak minimum. Pulse period must be approximately as shown below.

Frequency Selector Switch Setting	Pulse Period
0.1 MHz	10.0 microseconds
1.0 MHz	1.0 microseconds
5.0 MHz	0.2 microseconds
10 MHz	0.1 microseconds

   B. Repeat the above amplitude and frequency measurements at pins 14A and 14B of the Mainframe connector for 1.0 MHz and 10 MHz only, switching the switch S1 on the printed circuit board to the appropriate frequency for each measurement.

2. Using a wrist watch or timer with 1-second resolution, check the operation of the red and green timer lights. Turn off the power to the Mainframe and wait for at least 10 seconds. Using the watch or timer, check the length of time that the panel lamps take to change from red to green after the power is turned on. (If this alignment has not been performed before, R_t will be in place on the circuit board and the time for the lamps to switch from red to green will be 13 $\pm$ 1 seconds. After this reading is obtained, use a pair of wire cutters to remove R_t from the circuit board.) After R_t has been removed, the time for the lamps to switch from red to green will be 19 $\pm$ 2 minutes.

3. Allow the oscillator to operate with uninterrupted oven and oscillator power for at least 24 hours before performing the following steps.

4. Set the front panel fine frequency control to 9999. Select 10 MHz front panel output frequency and connect a frequency counter with an accuracy of at least 1×10^{-8} and resolution of at least 0.1 Hz.

5. For all new oscillators, and older oscillators exhibiting upward frequency aging, adjust the oscillator coarse frequency control (accessible through the top of the oscillator can) for a frequency of 10,000.0025 KHz. Older oscillators known to be aging downward should be coarse adjusted for a frequency of 10,000.0050 KHz.

   NOTE: Use a metal tipped non-metallic tuning tool for this coarse adjustment, and replace the coarse adjustment sealing screw as soon as possible after adjustment to avoid thermal disruption of the oscillator.

   The coarse frequency adjustment has a nominal sensitivity of 10 Hz/turn at 10 MHz, with clockwise rotation decreasing the frequency

6. Set the front panel fine frequency control to 0000 and adjust R26 for a frequency exactly 10.0 Hz (.0100 KHz) below that obtained in Step 5. Clockwise rotation of R26 decreases the oscillator frequency. Do not glyptol R26.

7. Set the front panel fine frequency control to 5000 and adjust R23 for a frequency exactly 5.0 Hz (.0050 KHz) below that obtained in Step 5. Glyptol R23.

8. Set the front panel fine frequency control to obtain a frequency counter reading of exactly 10 MHz, then calibrate to any greater degree of precision desired using a WWVB receiver or other suitable means.

> NOTE: R26 is a tracking control, and should be tuned exactly the same amount in the same direction as any future adjustments of the oscillator coarse frequency control, unless a complete oscillator realignment is performed.

9. After completing the above steps, continue monitoring the accuracy of the output frequency for several more hours until satisfactory accuracy and stability are verified. Then turn the oscillator off for at least 24 hours.

10. After the oscillator has cooled for at least 24 hours, final verification of frequency accuracy and warm up time will be obtained during the next 24 hours of test time. Turn the oscillator power on, and verify that the following accuracies are obtained:

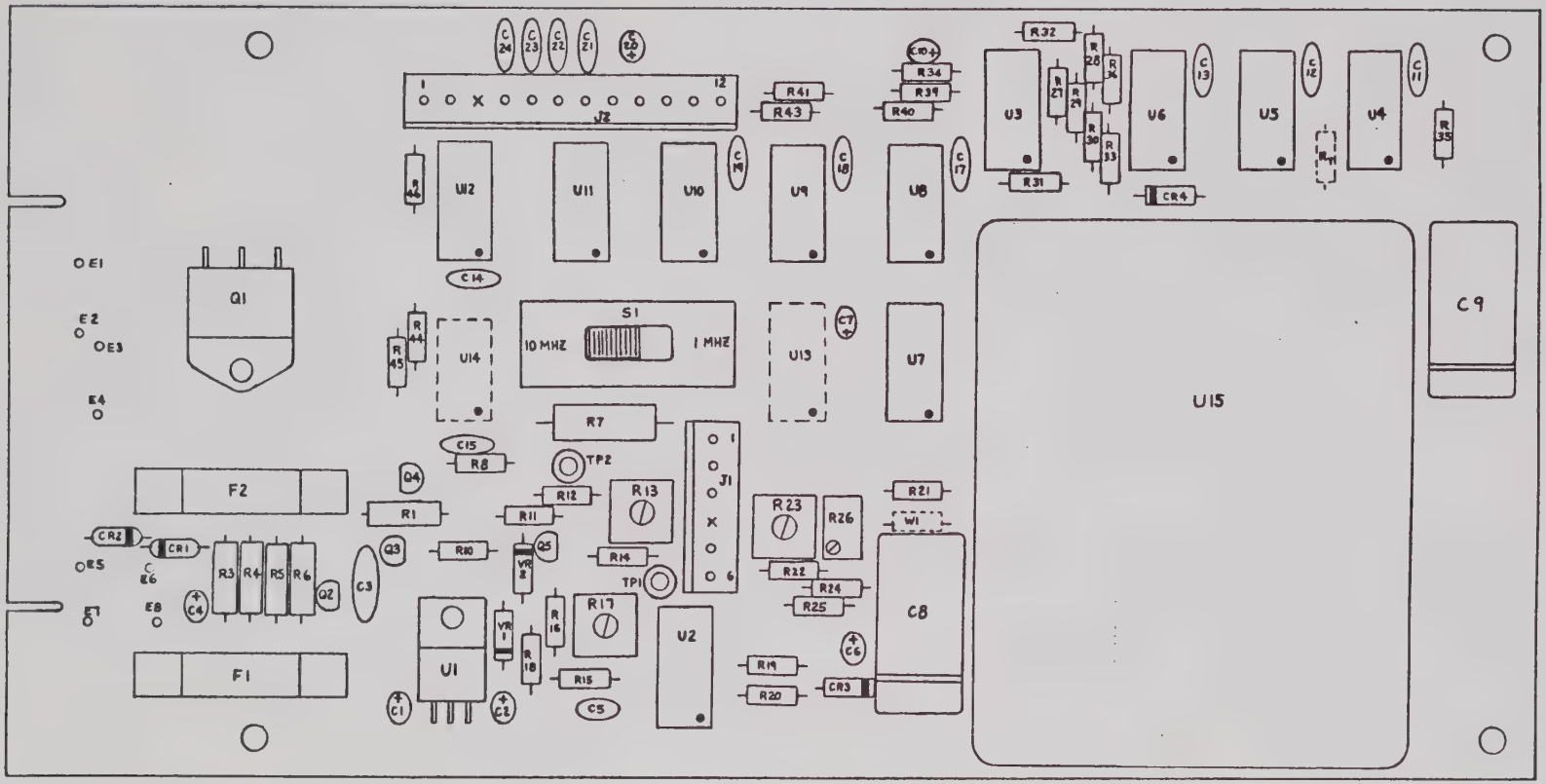
    Within $\pm$ 1 x 10^{-7} in ten minutes.
    Within $\pm$ 2 x 10^{-8} in twenty minutes.

Final Button-up and Inspection

1. Verify that the following items are satisfactory:

    a. Torque seal on potentiometers.
    b. Cap screws replaced on oscillator.
    c. R_t removed from circuit board.
    d. Internal switch S1 set at 1.0 MHz unless otherwise instructed.
    e. Replace side covers.

2. This completes this oscillator test procedure.



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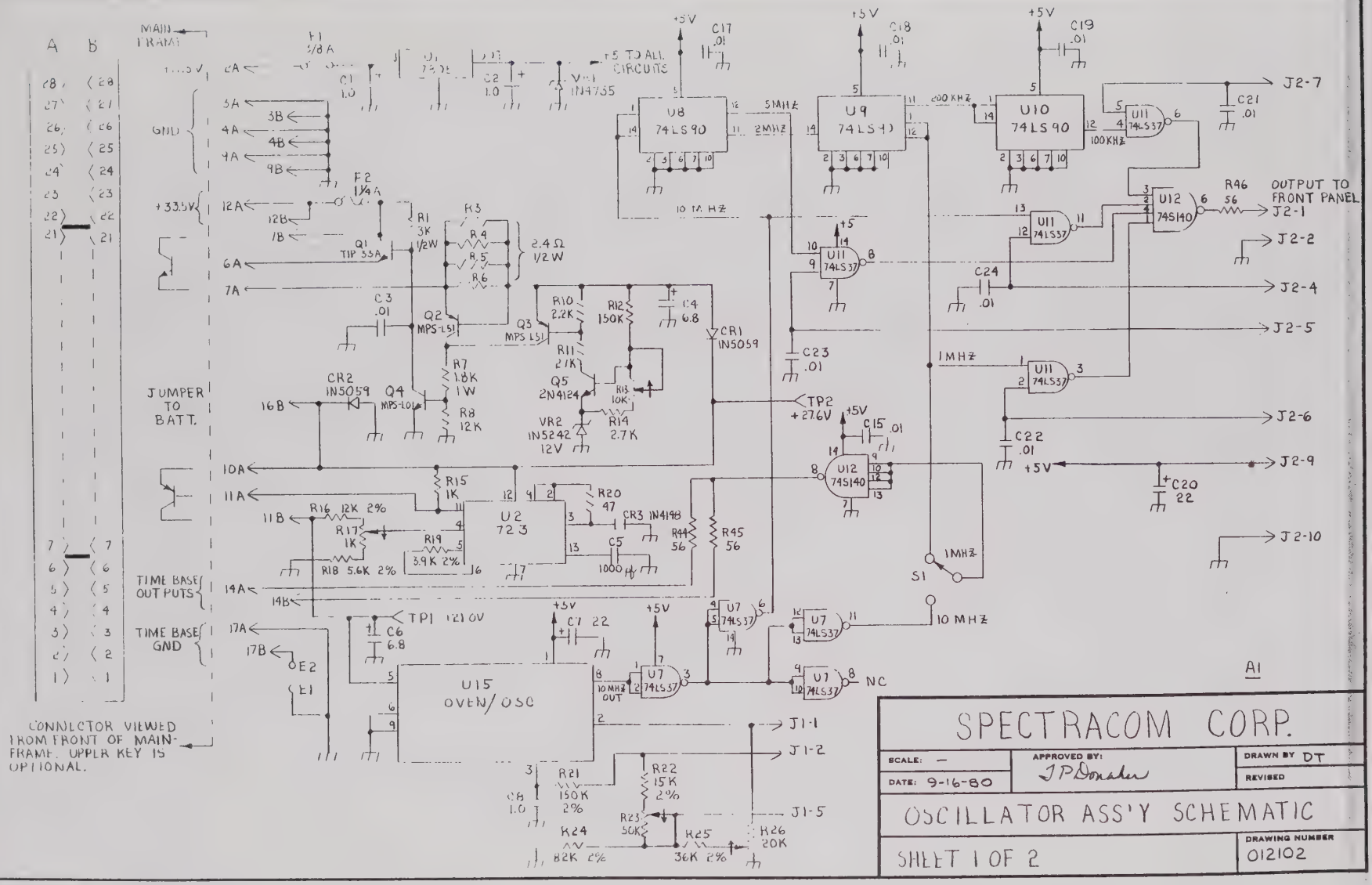

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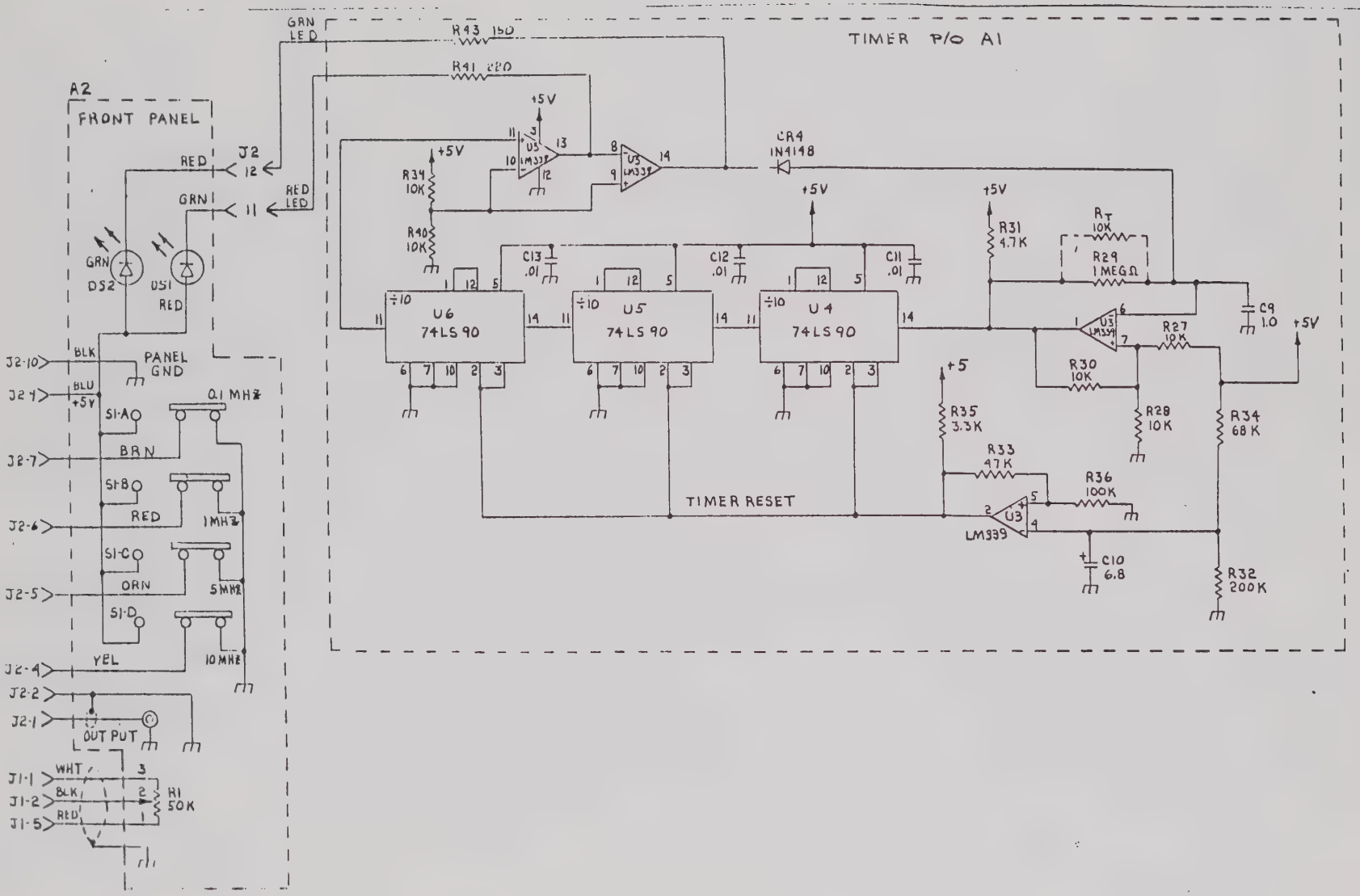

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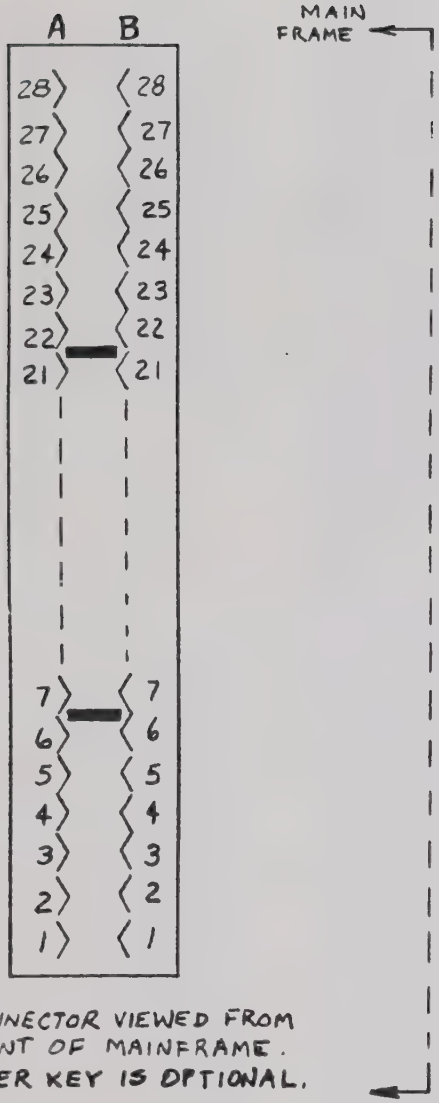
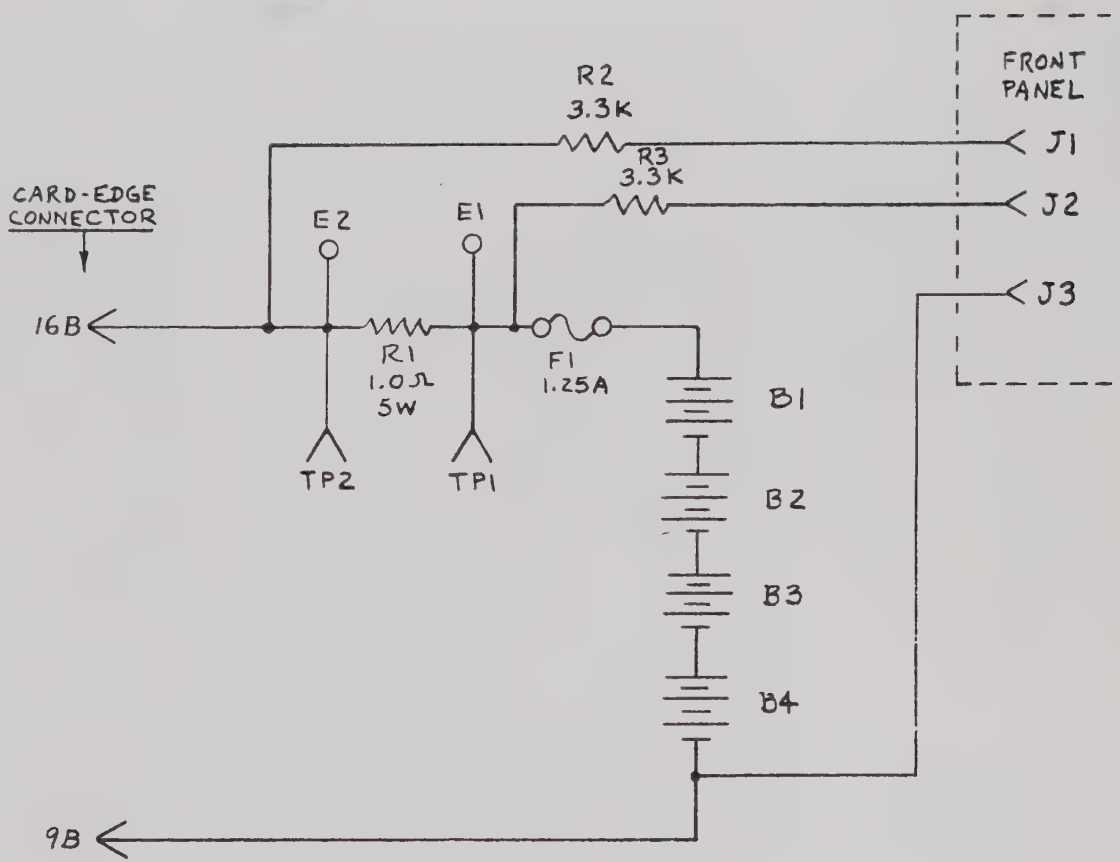


CONNECTOR VIEWED FROM FRONT OF MAINFRAME. UPPER KEY IS OPTIONAL.



NOMINAL NO-LOAD TERMINAL VOLTAGE FROM 9B TO 16B IS +24 VDC. FLOAT CHARGER HOLDS THIS VOLTAGE AT +27.6 VDC AT +25°C.

REV C 12-13-84 RJH
REV B 10-3-81 TPD

SPECTRACOM CORP.	
MODEL 8132	2/7/79
BATTERY PLUG-IN ASS'Y	
013002	SHEET 1 OF 1

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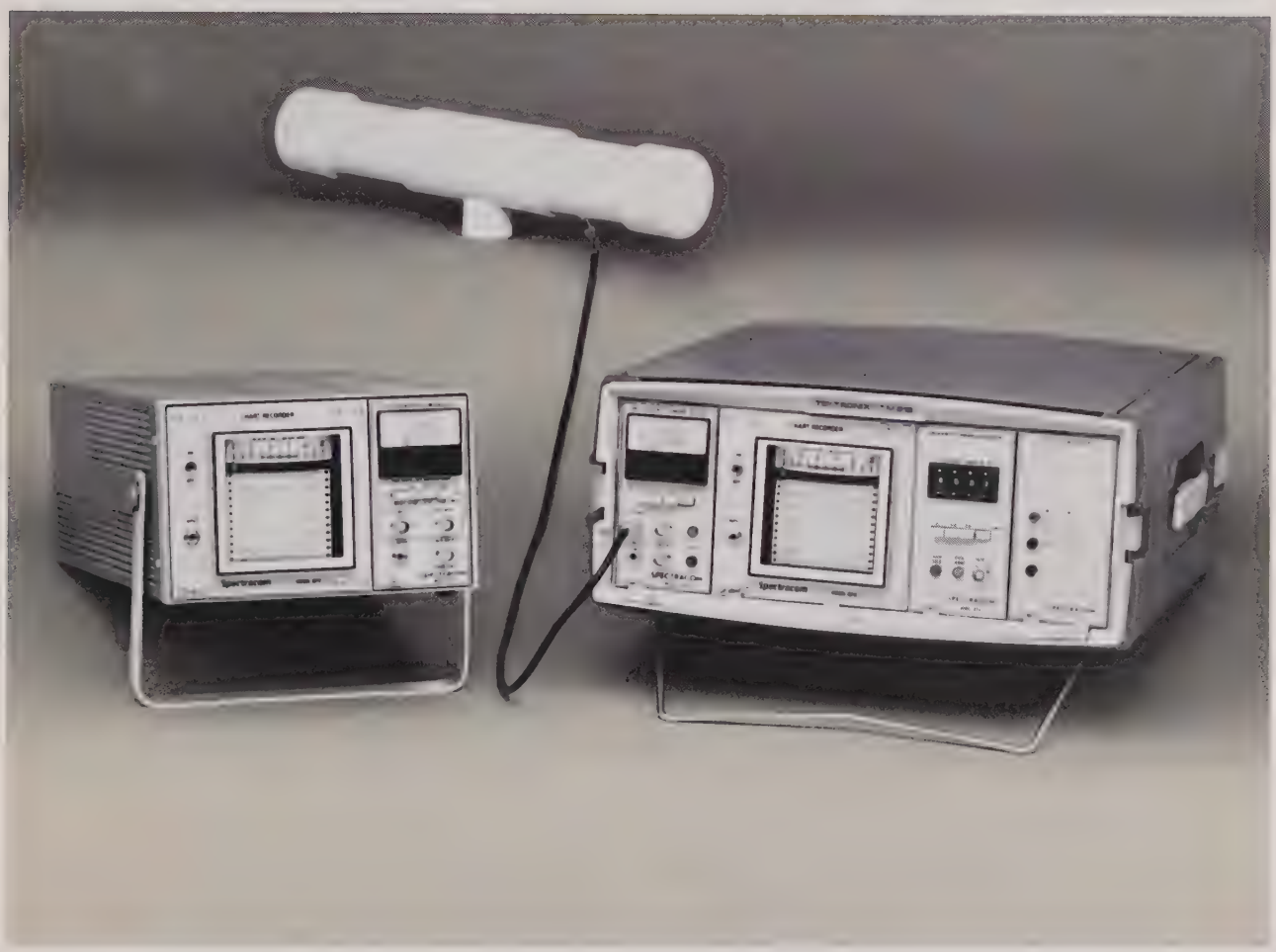
Frequency Standards & Calibration

TM-500/5000™ Plug-Ins



How to use WWVB
How to maintain NBS traceability
Application information
Product Specifications

- WWVB Receiver/Comparator
- Frequency Standard Oscillator
- Precision Phase Comparator

WWVB Receiver/Comparator Model 8163

The National Bureau of Standards transmits the national time and frequency standard via Station WWVB from Ft. Collins, Colorado. The Model 8163 brings the NBS standard frequency into your laboratory and lets you establish traceability for frequency and relative time.

WWVB calibrations using this equipment are possible throughout North America. For fringe areas such as Alaska, Puerto Rico, Hawaii, and Canal Zone, the use of Model 8207 Preamplifier is recommended.

This calibration method is universally accepted by QA and government officials. Operation is easy to learn, and receiver adjustment and calibration are easily performed in your own laboratory. Simple performance checks outlined in the manual serve as periodic receiver calibration procedure.

Improvements in receiver technology make this the finest WWVB Receiver available. Phase locking to the WWVB signal is achieved reliably even in areas of poor signal-to-noise ratio. The phase comparator monitors the error and aging of frequency standard oscillators operating at any of the four common standard frequencies.

The built-in phase comparator shows phase change of the Local Input signal (your oscillator) relative to the WWVB carrier frequency. If the meter needle stands perfectly still the phase is not changing and your standard is on frequency. If the meter drifts upscale or downscale your oscillator is high or low, respectively, in frequency. The fractional frequency error (e.g. parts in 10^9) is determined by noting the rate of change of phase indicated by the meter or an associated strip chart recorder.

Specifications

Received Standard Frequency: 60 KHz, NBS Station WWVB in Ft. Collins, Colorado. Transmitted frequency accuracy is $\pm 1 \times 10^{-12}$.

Sensitivity: 0.4 uV rms into 50 ohms. Minimum field strength at Model 8206 Antenna, 30 uV per meter.

Phase Locked Outputs: 0.1, 1.0, 5.0, or 10 MHz, front panel selectable. TTL-compatible positive rectangular pulses, 100-ohm source impedance. Phase locked to received WWVB carrier frequency.

Phase Jitter: typically less than ±0.3 microsecond.

Phase Comparator: Front panel meter indicates phase changes of Local Input signal with respect to internal phase locked oscillator. Internally selectable scales of 50 μsec and 10 μsec relative time. Aux Output panel jack provides drive to external 0-1 mA strip chart recorder such as Spectracom Model 8212.

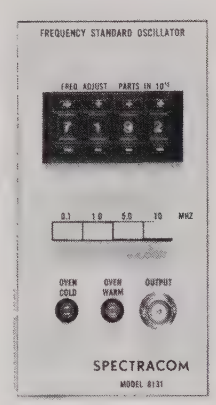
Comparator Local Input: 0.1, 1.0, 5.0, 10 MHz, front panel selectable, 100 mV rms minimum into 50 ohms.

Phase Lock Indication: Green panel lamp indicates phase lock. Red panel lamp indicates phase unlock due to antenna misdirection or disconnect, insufficient signal strength, etc.

Accuracy: 1×10^{-11}, as limited by the received signal-to-noise ratio. Resolution limitations are avoided by using longer measurement times to minimize the effects of atmospheric noise.

Model 8206 Loop Antenna: High gain directional ferrite loop in tubular housing 14½ L x 2¾ Dia. (inches), 368 L x 70 Dia. (mm). Built-in preamplifier receives its DC power over the coaxial cable from the receiver. Equivalent electrical height 5.0 cm.

Frequency Standard Oscillator Model 8131



A high-quality frequency standard such as the Model 8131 is a welcome addition to any laboratory where accurate or high-resolution frequency measurements are made. As a secondary frequency standard the 8131 provides accurate, stable, and low-noise standard frequencies for calibration of other frequency measuring and generating instruments.

Using the 8163 to track the 8131 oscillator against WWVB provides a house standard with much less short-term noise jitter than is provided by the NBS Output of the 8163 Receiver. This free-running quartz oscillator is packaged in a proportionally controlled oven to minimize the effects of environmental temperature changes. Front panel adjustment resolution of 1 part in 10^{10} allows ultra-precise frequency setting.

Frequency counters may be calibrated by counting the 8131 output, and adjusting the counter's internal clock oscillator until the counter readout exactly matches the selected 8131 output frequency. If the 8131 output is used as a counter time base, the counter then has the same accuracy as the 8131, plus or minus one count. Most stand-alone frequency counters have an external time base input jack on the rear panel. If the output from the 8131 is fed into this jack at the appropriate frequency, the counter accuracy is improved to that of the 8131.

Tektronix® frequency counters can use the 8131 as an external time base if an appropriate jumper is added to the mainframe rear interface connectors. Up to two counters in the same mainframe as the 8131 may be operated this way using a single 8131 as their common time base. Counter accuracies better than $\pm 1 \times 10^{-9}$ can be achieved.

To prevent warm-up and retrace delays if the power fails, Model 8132 Battery Power Supply may be used in the same mainframe as the 8131. If an appropriate jumper is added to the mainframe, the battery supply, when plugged in next to the 8131, will be float-charged when line power is on. If power fails or is turned off, the oscillator and oven circuitry in the 8131 will operate for up to 10 hours. When power is restored in less than 10 hours the oscillator needs no warm-up.

Specifications

Frequency Standard Outputs

Front Panel: 0.1, 1.0, 5.0, or 10 MHz, front panel selectable, TTL-compatible positive rectangular pulses, 100-ohm source impedance. Will drive 50 ohms with reduced amplitude.

Rear Connector Output to Mainframe: TTL output signal for use as external time base by Tektronix® TM-500 counters. Internal switch selects 1 or 10 MHz. Two outputs for mainframe jumpering to two separate counters.

Frequency Standard Stability

Aging Rate: 3×10^{-9}/day typical after 1 day on.
2.5×10^{-9}/day max after 30 days on.
1×10^{-9}/day typical after 30 days on.
5×10^{-10}/day typical after 120 days on.

Short Term Stability: 2×10^{-10} rms over 10 successive 10-second counts.

Temperature: $\pm 7 \times 10^{-9}$ over the range of 0-50° C.

Output Load: $\pm 1.0 \times 10^{-11}$ for any load change.

Supply Voltage: $\pm 2.5 \times 10^{-10}$ max. for ±10% change.

Warm-Up at 25° C: Within $\pm 1 \times 10^{-7}$ in 10 minutes, $\pm 2 \times 10^{-8}$ in 20 minutes, referenced to frequency after 24 hours on. Red & green panel lamps show 20-minute warm-up period from power on, corresponding to frequency accuracy of $\pm 2 \times 10^{-8}$.

Frequency Adjustments

Fine: Front panel control with $\pm 5 \times 10^{-7}$ range, and 1×10^{-10} resolution. Typically compensates for 3 years aging.

Coarse: Internal piston capacitor accessible at side of oven. Range $\pm 2 \times 10^{-6}$ minimum (10 years min.), resolution $\pm 2 \times 10^{-8}$.

Stand-By Battery Supply

Model 8132 Plug-in keeps 8131 Oscillator and oven only running for approximately 10 hours while main power is off. Rear connector terminals allow mainframe jumpering. Batteries are float-charged from mainframe when power is on, voltage and current limited and temperature compensated. Front panel test points allow monitoring of charge current and voltage.

How to use WWVB.

There are two ways that the WWVB signal may be used to calibrate a frequency standard oscillator. The quick way is to use a frequency counter whose time base oscillator is the one to be calibrated. By counting the very precise phase locked output frequency from a WWVB receiver, the accuracy of the counter's time base oscillator can be checked very quickly. However, the resolution of the measurement is limited to about 1×10^{-7}.

The second method for using WWVB for frequency calibration consists of measuring the change in relative phase between the oscillator under test and the WWVB carrier signal. If the relative phase is not changing, then the standard oscillator is exactly on frequency. If there is an error in the standard oscillator's setting, then the relative phase will change at a rate that is proportional to the size of the error. For this higher resolution measurement, the receiver's built-in phase comparator is used. By watching the panel meter, resolution of parts in 10^7 or 10^8 may be achieved. By using a strip chart recorder and making the measurement over a longer time period, resolution approaching 1×10^{-11} can be achieved. Using the recorder provides a permanent record of your measurement, as required in many applications.

To use the phase comparator, feed the signal to be measured into the Local Input jack. Fractional frequency error is calculated by dividing the amount of relative phase change by the time it took to change. In the example shown here, a phase change of 11 microseconds occurred over a 1.0-hour period. The frequency error is calculated like this:

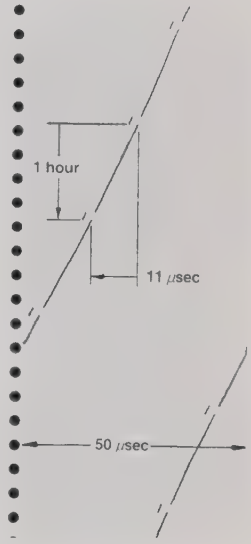
$$\text{Frequency Error} = \frac{\text{Relative Phase Change (seconds)}}{\text{Duration of Measurement (seconds)}}$$

$$= \frac{11 \times 10^{-6} \text{ seconds}}{3600 \text{ seconds}}$$

$$= 3 \times 10^{-9}$$

If the phase drift was upscale, the Local Input frequency was high compared to WWVB; if downscale, the Local Input frequency was low.

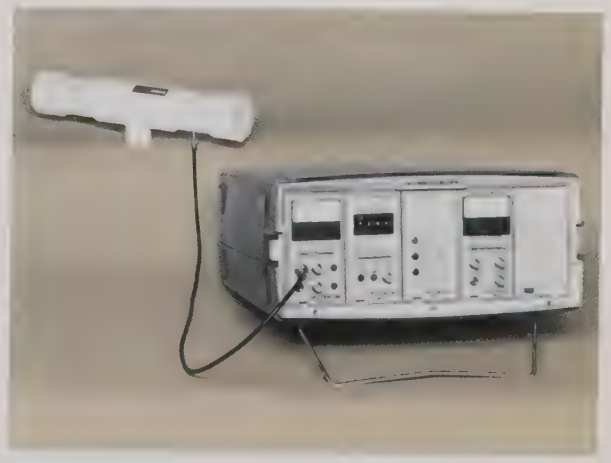
You can see the basic process of calibrating an oscillator and adjusting its error to a very low value requires you to make the meter needle stop moving either up or downscale. The slower the relative phase drift, the smaller the oscillator error. In the above example, if the meter reading had changed 11 microseconds in a *ten*-hour period, the error would have been 3×10^{-10}. If it had taken one tenth as long as in the example, or 0.1 hours, the error would have been 3×10^{-8}.



Complete Frequency Calibration System

All four Spectracom plug-ins mounted in a TM-504 mainframe constitute a complete laboratory or portable frequency calibration system. The Model 8163 Receiver with its Antenna provides constant monitoring capability, allowing the user to compare the 8131 output frequency with the Bureau of Standards at all times. When the system is moved to another location, perhaps away from the antenna installation, the 8131 Oscillator is kept warm during travel by the 8132 Battery Supply in the same mainframe.

At the remote site, frequency calibration may be performed, after plugging in the equipment, using the Model 8150 Phase Comparator to compare oscillators and time bases with the Model 8131 output frequency. When calibration at the remote site is complete, the unit is carried back to its original site where, after power is restored, the 8163 WWVB Receiver is again used to monitor the frequency output of the oscillator. Thus, this system provides fixed-station or portable frequency calibrations at multiple sites.



Which Plug-Ins Should I Buy?

If you want to calibrate frequency counters now and then, the Model 8163 Receiver/Comparator will fill most of your needs. It gives you traceability to NBS, and with a Model 8212 Strip Chart Recorder it lets you make long-term measurements that are highly accurate.

You should have a house frequency standard such as Model 8131 Oscillator if you need a frequency source with good short-term and long-term stability; if you need a transfer standard; or if you need an external time base oscillator for your counter that is orders of magnitude better than the internal one.

The Model 8150 Precision Phase Comparator is used when you have two signal sources that must be accurately compared. The 8163 lets you compare one local signal to NBS, and the 8150 lets you compare a local signal to another local signal, such as the Model 8131 or an atomic standard. The 8150 lets you make the measurement much faster with higher resolution due to its more sensitive scales. Using the Model 8212 Chart Recorder with the 8150 can provide measurement resolution of 1×10^{-14} in about three days.

The 8132 Battery plug-in is needed if you must eliminate warm-up and retrace time when power is removed from the 8131 Oscillator. It enables portable operation with fast start-up.

Mechanical Information

Temperature Range: These Spectracom plug-in instruments are designed to operate in a temperature range of 0–50° C. Because the power dissipation of these plug-ins is low, all of them may be operated in the same mainframe without excessive temperature rise.

Size: All plug-ins fit into any TM-500 or TM-5000 Mainframe. The approximate size of each plug-in is 5H x 2.6W x 11D inches (127 x 66 x 280 mm).

Weight:

Model	*Shipping*	*Alone*
8131	4 lb	2 lb
8132	7 lb	4 lb
8150	4 lb	2 lb
8163	5 lb	2 lb

Panel Connectors: All panel I/O connectors are Type BNC except for the Aux Output chart recorder drives on the 8150 and 8163, which are miniature phone jacks. The test points on the 8132 panel are tip jacks.

Accessories

Model 8132 Stand-By Battery Supply. A single jumper wire in the mainframe connects this plug-in to an adjacent 8131 Oscillator to protect against power shutdown for up to 10 hours. Front panel terminals allow monitoring of charge voltage and current.

Model 8206 Loop Antenna. High gain directional ferrite loop in tubular weather-sealed housing. Size 14½ L x 2¾ Dia inches, 368 L x 70 Dia mm. Built-in preamplifier receives DC power over the coaxial cable (RG-58 is recommended) from the receiver. Equivalent electrical height is 5.0 cm.

Model 8207 Preamplifier: Tuned 60 kHz amplifier used in the antenna feed line in fringe areas. Not needed in southern Canada or U.S. except Alaska or Hawaii. Recommended where signal strength is less than 50 uV/meter at the Model 8206 Antenna. Provides 40 dB of gain, gets DC power from the receiver on the coaxial cable. Size 5 x 3 x 1.7 inches, 127 x 77 x 43 mm.

Model 8212 Strip Chart Recorder: Driven from Aux Output jack on front panel of 8163 Receiver or 8150 Phase Comparator. 50- and 10-microsecond meter scales. Mounts in a Tektronix® Mainframe. See 8212 data sheet for additional details.

Model 8211 Antenna Mount. Freestanding base and non-metallic mast with two 2-foot sections for mounting Model 8206 Antenna. Use of a single 2-foot section is recommended for most installations. Base may be weighted or fastened to roof for wind stability.

Mainframes. Provide power and enclosure for the plug-in instruments described in this brochure. The following mainframes are offered by Spectracom:

TM-501 Single Compartment
TM-503 Three Compartments
TM-504 Four Compartments
TM-506 Six Compartments
TRM-506 Six Compartments with rack mount
TM-515 Five Compartments, suitcase style

Additional Instruction Manual. One manual is furnished with every instrument. Additional manuals may be purchased as needed.

Specifications are subject to change without notice.
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